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FORTHCOMING MEETINGS

WEDNESDAY, 19TH JANUARY, at 2.30 p.m. CADMAN MEMORIAL LECTURE. '*Research in the Coal Industry*', by W. Idris Jones, C.B.E., B.Sc., Ph.D., Director-General of Research, National Coal Board. The Hon. L. W. Joynson-Hicks, M.A., M.P., Parliamentary Secretary, Ministry of Fuel and Power, will preside. (The lecture will be illustrated with lantern slides.)

THURSDAY, 20TH JANUARY, at 6.30 p.m. DISCUSSION on '*Television—Friend or Foe*'. Opening speaker: Mrs. Mary Adams, O.B.E., Director of Television Talks Features, B.B.C. (Refreshments will be served from 5.45 p.m. For further details see notice in the last issue of the *Journal*.)

WEDNESDAY, 26TH JANUARY, at 2.30 p.m. '*The Chalon Portrait*': *a survey of the postage stamps copied from the portrait of H.M. Queen Victoria painted by A. E. Chalon, R.A., in* 1837, by Robson Lowe. The Right Honble. Earl de la Warr, P.C., Postmaster-General, will preside. (The paper will be illustrated with water colours, engravings and postage stamps.)

WEDNESDAY, 2ND FEBRUARY, at 2.30 p.m. '*The Reconstruction of the Dutch Railways*', by Ir. F. Q. den Hollander, President, Netherlands Railways. His Excellency The Netherlands Ambassador will preside.

THURSDAY, 3RD FEBRUARY, at 5.15 p.m. COMMONWEALTH SECTION. SIR GEORGE BIRDWOOD MEMORIAL LECTURE. '*Chandigarh and Planning Development in India*', by E. Maxwell Fry, C.B.E., B.Arch., F.R.I.B.A., and Jane B. Drew, F.R.I.B.A. H.E. Mrs. Vijaya Lakshmi Pandit, High Commissioner for India will preside. (The lecture will be illustrated with lantern slides. Tea will be served from 4.30 p.m.)

Fellows are entitled to attend any of the above meetings without tickets and may also bring two guests. When they cannot accompany their guests, Fellows may give them special passes, books of which can be obtained on application to the Secretary.

RECEPTION AT ST. JAMES'S PALACE

The Chairman of Council and Mrs. Rantz receiving guests in the Tapestry Room

Sir William Reid Dick, R.A. (Albert Medallist) and Lady Reid Dick being presented to His Royal Highness

Above: *The Earl and Countess of Radnor receiving guests in the Picture Gallery*

Right: *The President with members of the Council (The Chairman, Sir Alfred Bossom, Sir Frank Brown)*

His Royal Highness the President passing among the guests in the State Apartments

BICENTENARY RECEPTION PHOTOGRAPHS

Several of the photographs taken at the Reception at St. James's Palace on December 15th are reproduced above. Numerous other photographs were also taken on that occasion and arrangements have now been made for copies of any of them to be made available to Fellows who require them.

Numbered proof prints of those not reproduced above can be seen for identification purposes at the Society's House, or can be sent on loan to Fellows who apply to the Secretary. Orders for finished photographs should be sent direct to Mr. J. L. Bacon, 1 South Park Hill Road, Croydon, Surrey, giving the *Journal* reference or proof reference number and accompanied by a remittance. The cost of the photographs, which will be 8 inches by 6 inches in size, is 4*s.* 6*d.* each, including postage.

DEATH OF MR. J. GRENFELL WILLIAMS

We record with great regret the death on Tuesday, 28th December, of Mr. J. Grenfell Williams, Head of the Colonial Service, British Broadcasting Corporation, who read a paper at the first meeting in the present Commonwealth Section programme on 'The Development of Broadcasting in British Africa'. A report of the meeting will be found on page 113 of this issue of the *Journal*.

SCIENCE AND FOOD PRODUCTION

The E. Frankland Armstrong Memorial Lecture by

LESLIE H. LAMPITT, D.Sc., F.R.I.C.,

a Director and Chief Chemist, J. Lyons & Co., Ltd., delivered to the Society on Wednesday, 17th November, 1954, with Sir Charles Dodds, M.V.O., M.D., F.R.S., Courtauld Professor of Biochemistry, University of London at Middlesex Hospital Medical School, in the Chair

THE CHAIRMAN: We are gathered here to participate in the second E. F. Armstrong Memorial Lecture. It would be presumptuous on my part if I were even to refer to the great part that Dr. Armstrong played in the affairs of the Society, but I should like, with your permission, just to point out to you what a master Dr. Lampitt is in the subject in which he is about to address us. He was trained as a chemist and before the 1914–18 war he was mainly concerned with cereal chemistry. At the end of the war he came out of the army after a very distinguished career right in the thick of the fighting and began a laboratory in the firm of Lyons, in which he is now not only the Director of the Research Laboratories but also a Director of the Company.

Now I think I am right in saying that at that time, 1918, chemistry played very little part in the food industry, apart from very perfunctory and slight analytical control, and Dr. Lampitt really entered the firm to see what he could do by bringing chemistry into the food industry. Now, I hope, Dr. Lampitt, if I say that your firm is noted for its keenness in every variety of its activities, I will not be misunderstood, but when you think of the enormous institute of research that Dr. Lampitt has built up, one can only assume that it has proved itself a practicable and a paying proposition in every way; and I think I would be right in saying that Dr. Lampitt really brought to the food industry the incomparable advantages of chemistry.

Now that, in itself, would be a very great achievement and Dr. Lampitt would need no further encomiums from myself, but I would like, on this occasion, to pay tribute to another of his activities, namely, the zeal with which he has pursued the interests of this country in the field of international representation of chemistry. Few chemists really know of the importance of this work and he, as Treasurer of the International Union of Pure and Applied Chemistry, and a high official of many of its Councils, has done more than anybody else at the present time to maintain the position of this country in the international field at a high level.

The following lecture was then delivered:

THE LECTURE

Presumably it may be taken for granted that the application of science to any phase of human life involves a story of adventure and imagination. Certainly this is so in the world of food—never more so than to-day; and in trying to paint a picture of that adventure and of that imagination I have an unlimited canvas on which to paint in detail or sketch suggestively. It will, however, be an imperfect

picture, but indicative of the wealth of aspects from which the impact of science on food production, an impact on every aspect from the soil to the final consumption of the food itself, can be seen.

Scientists have a great heritage. The original practitioners of the philosophic school were mostly concerned with the why and the wherefore of natural phenomena and very early in the history of the world the results of the cogitations of these philosophers were applied by them, and through them by other people, to the conservation of the products of nature in a rudimentary 'applied science' form. The medical men of China, the priestly cults of Egypt, the thinkers of Greece and Rome were the forerunners, worthy forerunners, of the hosts of scientific workers of to-day.

The thinker and the observer preceded the 'results by experiment' type of approach, but in all cases there was active progression of thought, of observation and of experimental result to their application in a practical way. The resolute attempt to divide science into pure and applied was more an idea of the early nineteenth century than of anything earlier, and resulted in a fallacious attitude on the part of those engaged in fundamental research in universities to the work of scientists who were outside the university aura.

To-day, most of the occupants of chairs in universities, particularly in chemistry, physics and medicine, contribute directly to industrial development, and much research work in universities is paid for directly by industry.

To-day, also, much is being rediscovered, as it has been throughout the ages. A Latin 'Bestiary' of the twelfth century has lately been translated, a bestiary based on a late Roman Empire 'Book of Beasts'. In it is to be read—for the translator has added copiously his own comments—'that ants have the secret of arresting the germination of seeds'—a fact 'discovered' by a Mr. Traherne Moggeridge in 1873, although it had been known to Acilian in the second century and experimentally proved by Sir Thomas Browne in the seventeenth century.

Are we then to pour scorn upon the seers and witches of the Middle Ages, or even to deride the Witches' Cauldron?

> Round about the cauldron go:
> In the poisoned entrails throw.—
> Toad, that under cold stone
> Days and nights has thirty one,
> Sweltered venom sleeping got,
> Boil thou first in the charmed pot.
>
> Fillet of a fenny snake,
> In the cauldron boil and bake;
> Eye of newt, and toe of frog,
> Wool of bat, and tongue of dog.
> Adder's fork and blind worm's sting,
> Lizard's leg and howlet's wing,—
> For a charm of powerful trouble,
> Like a hell broth boil and bubble.

What were the ingredients, the constituents extracted from such mixtures? It may not only have been the psychological approach of the witch to her patient or her patron. . . . We too have our cauldrons, and as we examine their contents, as through a glass darkly, we begin to see a pattern—a pattern in which are pinpointed certain combinations, formations, groupings, which are pleasing to the eye. We begin to differentiate between the essential and the background. We begin to realize that certain combinations are necessary to complete understanding of biochemical matters—and, of course, food is biochemical.

In considering some of the aspects of my theme I would take, as a simple basis of division of the subject, three sections into which science, as applied to industry, can be divided: the fundamental investigation, the application of the results of the fundamental to applied projects and the use of science simply as a control tool.

In these days the development of knowledge is most complicated and the relative positions of the university, of seats of higher education, of government research stations, of research associations and of private industrial laboratories are hard to define because, to a large extent, they live one on the other.

In this connection there has lately been held in Nancy a symposium, sponsored by the Organization for European Economic Co-operation under the title 'Co-operation in the field of Applied Research between National Institutions, Industry and Establishments for Higher Education'. Delegations from some nineteen nations took part and I was particularly interested to realize there how much behind the Latin countries were in comparison with the Anglo-Saxon.

The unique position of the university is as a training ground. It must be remembered that scientists are not a race apart, a 'peculiar people'. In many cases they are scientists by chance. A boy or girl may become a historian, a botanist, a philosopher or a bacteriologist, by chance—depending largely on the romantic ideas put into his or her head by casual contact with people at school, or met socially. It does not follow that a high academic degree of necessity indicates a research mentality and it certainly does not indicate that the possessor will be in any way useful in walks of life outside a university.

A violinist at the corner of the street may have had a brilliant student career but if he plays at the corner of the street there is something lacking in his make-up. A scientist may be pedestrian all his life even if he has a research degree . . . he lacks something.

The university, therefore, trains the student in the fundamentals of his science, the professor uses him as a pair of extra hands during post-graduate work and should, thereby, be able to discover the true research-minded individual; a research worker needs a background knowledge, imagination and the spirit to gamble.

Obviously, for the development of an industry, fundamental work is a most important prerequisite. It would be quite simple to indicate a number of industries which have developed from the work of the scientist—for example, the plastics industry—but in words I used on a previous occasion, I will give an example which I consider rather outstanding:

> Who would have thought, [I said] that the classic research of my old professor, Adrian J. Brown, on the semi-permeable membrane of the barley seed, entailing thousands of analyses, would have initiated the work of H. E. and E. F. Armstrong forty odd years ago on the leaves of the cherry laurel and be further applied to the 'gas ripening' of fruit! In this connection it is interesting to remember that the Armstrongs sought to apply the name 'hormone' to bodies that their treatment of leaves stimulated or released, an application that Starling, who had first used the word 'hormone' and who had defined it as a 'chemical messenger' in animal physiology, strenuously opposed. By careful analytical procedure the Wents, father and son, at Utrecht, had proved that growth-regulating substances were formed in the leaves of plants and transmitted backwards and had actually separated β-indolylacetic acid. Need the importance to industry of the careful analytical work of A. J. Brown, of the Armstrongs and of the Wents be stressed when out of it has developed the 'plant hormone' industry of to-day?

This aspect of the influence of the scientist on agriculture is but an example of the importance of growth regulating substances—just one section of a whole field of progress. Insecticides, fungicides, and herbicides are other spheres in which development has been going on with its ever-increasing momentum. The number of inoculations and injections to which calves, pigs and sheep are subjected all increase the potential for food production. Imagination and adventure! Let me remind you of the two lambs from a ewe every year already achieved. In southern Italy I have lately seen a farm carrying 1,200 head of dairy cattle, at which breeding is entirely done by artificial insemination. Such are some of the advances which affect the potential food supply of the world to-day.

I would refer again to insecticides and fungicides, and numerous examples could be quoted of the way in which science has affected the trend and the practice of agriculture in respect of food products. Since D.D.T. was synthesized and became a commercial proposition, a great array of chemical bodies are now available to the agriculturist, and crops which would have been ravaged by insects and fungi have been saved. Whole areas in the tea districts of Ceylon would have been devastated by a kind of blight had it not been that the Research Station at St. Coombs had found the corrective treatment, and the gardens in certain parts threatened by extinction now flourish like the proverbial bay tree. Science, too, has made it possible to work areas which previously were untenable. The mighty attack on the mosquito is an example: 22,000 workers died during the few short years the French were trying to cut the Panama Canal, chiefly through malaria. The American company sprayed the whole of the area with paraffin at the beginning of the century and in 1914 the canal was opened. It is only fifty years ago that such crude methods had to be adopted and now scores of chemicals can be used to effect the same result much more easily. I remember the time when that mosquito-infested area of Postumia in Italy was only fit for wandering herds of thick-coated, almost wild cattle. Fifty years ago, it was dangerous to go there; Mussolini tackled the problem and by draining and spraying turned it into a market garden where I have seen spring vegetables,

tomatoes and such-like growing in profusion. Moreover, the Greek temples and Norman castles can now be visited.

This year I have seen the area round the ruined city of Pollenaruva in Ceylon where, in the thirteenth century, two million people lived and raised the most fantastic palaces and temples. It is in the midst of jungle, on the edge of the great artificial lake of 6,500 acres, and it is mosquito infested. The Ceylon Government are at a place nearby clearing the jungle to grow sugar cane and this has only become possible by the extensive use of insecticide.

Science may quite easily change the face of an industry. As an example the citrus fruit industry of Sicily may be mentioned. In the old days, lemons were hand pressed for the oil from the skin of the fruit, the fruit was cut in two, the two parts were pressed for the juice, the empty caps were brined and eventually made into candied peel. The juice was partly sulphited to preserve it and partly used to give citric acid. A very simple set of processes which ended in the utilization of the whole lemon. But chemistry discovered how to synthesize citric acid in such an economic way that synthetic citric acid produced in the using country is cheaper than imported natural citric acid. The whole economics of the Sicilian lemon industry were upset. Other changes too are imminent. For years experiments have been conducted with the object of concentrating the juice of lemons and oranges without impairing their flavours. Science has now shown how this can be done economically so that a four-times concentrated juice can be produced, and it appears that the reduction of freightage (only one-fourth of the normal) more than off-sets the cost of evaporation of the water from the juice. And to round off this tale of citrus fruits, it appears it may be economically possible to freeze the juice and transport it without sulphur dioxide as a preservative.

Science, too, may upset the economy of a nation. Under the direction of Professor Marston of Adelaide, nine million acres of the so-called 'arid zones' northwards are to be sprayed from aircraft with a solution of certain mineral salts in which the soil is deficient. Experiments on large-scale areas have shown that the soil is not arid by the lack of moisture, but by lack of these mineral salts. Treatment results in the growth of grass. In five years it is estimated that every acre will bear two sheep, a total head of 18 million sheep. One of the important factors in the economy of New Zealand is the production of sheep, as of course it is in Australia, but the addition of this first lot of 18 million sheep may be a factor not only in the wool trade of the Islands but also in the carcass trade.

Science may also affect the face of Malaya. Malaya has been dependent essentially on rubber and tin. Synthetic rubber may at any time compete with natural rubber in price (in fact, subsidies in the United States make this possible: having no rubber lands it must for defence purposes keep its synthetic rubber plants in part operation), and I lately saw rubber being grubbed up and the palm which produces palm oil and palm kernel oil being planted. No satisfactory synthetic oils and fats have yet been produced and, moreover, the world still needs more fats. So a new food industry is starting in Malaya.

The period during which plant growth regulating substances were discovered

also saw the birth of new ideas regarding metabolism which have had a great, and may have a far greater, importance on the production of food.

E. F. Armstrong, whose second memorial lecture this is, spoke of this in 1912, when he reviewed the work of the preceding years: the work of Hopkins at Cambridge, of Stepp, Holst, Fraser and Stanton and of Funk—those vague searchings after what we know to-day as vitamins. The last two generations have seen the development of the knowledge of the chemical constitution, of the occurrence, of the ever-growing number of these absolutely essential ingredients of food, increasing in impetus continually. And the scientist associated with food manufacturing firms has had to translate the findings so that these substances, occurring in such minute amounts, are neither lost nor destroyed. Milk in a bottle standing on the doorstep in the sunlight is rapidly losing its ascorbic acid; the propaganda of the Ministry of Food during the war relating to the cooking of green vegetables was simply to preserve as much ascorbic acid as possible: ascorbic acid was more important than the palatability of the cooked green vegetable. These are but two of the most obvious examples; many others could be quoted—examples where the knowledge of the desirability of retaining vitamins has reacted upon food manufacture. There is sometimes a nice balance between palatability and nutritional value. A product of high nutritional value may be unpalatable and therefore not eaten in sufficient quantity; a very palatable food may be nutritionally poor. Reference here is not made to the heat giving parts of a food nor to those flesh building or repairing ingredients. Carbohydrates, proteins and certain metallic elements there must be, but no being can exist on these three alone. Vitamins, the regulating, the controlling substances, must also be present.

These advances are essentially due to the development of the knowledge of substances occurring in minute proportions so that they may be recognized and, in certain cases, accurately estimated in amount and in some cases synthesized: synthetic ascorbic acid is a case in point. The food manufacturer has through his scientific staff to learn how to conserve the maximum of these ingredients of the food products with which he is concerned. A food, 'purified' according to the old standards, may be depleted of certain ingredients which once were thought to be of no significance.

A classic example of this is the polishing of rice: the almost pure white product has had removed from it an ingredient essential to the dietary of those races which are rice-eating. The same may be said of white and not-so-white flours: the second type includes entities which are essential for well being, although in a mixed dietary this is not so overwhelmingly important as when, for example, rice is the almost complete dietary of a nation.

Occasionally, however, our nutrition experts go wrong. Their enthusiasm leads them up strange roads of thought and sometimes of action.

Some years ago, at a time when I was a member of the Food Investigation Board—that important body which sprang from the inspiration of that great man Sir William Hardy—Sir Edward Mellanby, then Secretary of the M.R.C. voiced the opinion that butter was being spoiled nutritionally by its low calcium

content and that, to improve it, the calcium content of the milk from which it was made should be restored to it. I was very sceptical of the idea but in order to satisfy Sir Edward I had some butter made to which the calcium was restored. I sent it to him to eat. Presumably he found it unpalatable as nothing more was heard of the matter.

One other incident. Professor H. E. Armstrong, the father of the man in whose memory this lecture is being given, was very keen on nutrition and with Dr. Friend, the Medical Officer of Christ's Hospital, watched the progress of the boys in the school and sometimes carried out experiments. At a certain time they decided that the entrails, practically entire, of a pig would have an enormous effect on the health of the boys. How to present these entrails in such a form that the boys would eat them was a problem. At last, however, they decided on sausages and I was asked to have such sausages prepared. This was done. At the time I had a nephew at the school—he was quite small then—and in his weekly letter to us he told us how many boys had been made sick by the 'filthy' food. That experiment, too, stopped.

It is interesting to recall that Armstrong was one of the great workers in the field of enzyme chemistry, some twenty communications being made by him between the years 1903 and 1913 on this subject. Most of these papers were concerned with the sugar splitting enzymes but through this work a better indication was obtained of the exact mode of action of these chemically active constituents of biological material. The influence of enzyme action in food manufacture is of first importance: the transformation of flour into bread depends on naturally occurring enzymes in the flour and on those produced by the yeast during fermentation; the brewing of beer depends upon the enzymes secreted by the sprouting barley and by the yeast during the subsequent fermentation of the extract made from the malt; during the hanging of a carcass of meat, enzyme changes are going on; the ripening of cheese is dependent upon the action of enzymes secreted by the particular micro-organism in use.

It will readily be realized, therefore, how important is a knowledge of these complicated chemical entities in food production, for it is only when the fundamental mode of action is understood that control can be effected.

And so I pass from these aspects of the fundamental to the second of my sections, namely the application of the knowledge gained to the actual production of food. Here I would divert for a moment to refer to a modern trend—not only in food, but in many phases of life.

Madam Schiaparelli has just published a book in which she traces the rise and fall of her famous house of fashion. Schiaparelli was an artist, for not only did she dress the world of fashion but she inspired manufacturers to produce wonderful fabrics. This book, *Shocking Life*, leaves one with a feeling of sorrow, as do also the empty premises in the Place Vendôme, and, as Cyril Connolly said, 'She lived to see the world of fashion turn into a mammoth industry and the Rue de la Paix invaded by 7th Avenue'. Another book *Always in Vogue*, by Mrs. Chase, tells a similar story and, I quote from the author, 'I believe in democracy, but in the autumn of my life I am saddened by that quality native

to the present time, the vulgarization inherent in the mass production of everything, including human beings'. We may not agree with Mrs. Chase, but both these books point to the same thing: mass production.

It is not necessary to delve into the reasons for mass production. It cheapens everything and in a country such as ours, where the available margin between earnings and net is so small, this has become a vital factor, and it also enables the natural aspirations of the lesser income strata to imitate the doings of the higher income strata to be fulfilled.

Schiaparelli and Mrs. Chase are only examples of the general trend; food is but another example. The chefs of the world, artists in gastronomy, served the few—the few who knew how to build a meal when jaded appetites had to be titillated by some special dishes, by some curious blending of flavours which, none the less, were satisfying, and to work in close collaboration so that the wine suited each dish as it was placed on the table. How many people can afford to eat as indicated by the late Professor Saintsbury? Very few indeed. These people were nearly all 'gourmets' and not 'gourmands'. How many people living thirty years ago could afford to eat a Bouche à la Reine or to order a Péche Melba? Now all and sundry can order chicken vol-au-vent—or canned peaches with Melba sauce. The chef is still an inspirer but the scientist, together with the engineer and factory manager, the people who translate the ideas of the chef into mass production.

A chef making a sauce adds his ingredients one by one, tasting all the time until he gets the desired result: but the sauce is rarely the same two days running. The result depends on his palate. He works with a small quantity. To translate his recipe into batches of hundreds of gallons at a time requires other controls than the palate. To imitate the expert stirring the chef gives his sauces necessitates scientific knowledge of the physical state of the ingredients. If the chef makes a mistake, he can, in many cases, rectify it; no such risk can be run in production on a large scale. In the past, by trial and error, the expert factory manager could copy the chef's work in its simpler forms, but this now largely depends upon the scientific staff of a food producing firm.

Much benefit accrues from mass production, apart from the two examples I have mentioned: there is greater uniformity and there is greater purity of the products. It is unfortunate, but almost inevitable, that the increase in legislation in the realm of food reacts more unfavourably on the small manufacturer than on the mass producer. The larger manufacturer has more control of the raw material used and of the processes themselves. The large caterer will not be worried by the projected regulations or agreements regarding the sanitary state of kitchens and services, but it may go hard with the thousands of small restaurants and eating houses.

It is very easy to quote many examples of the use of science in mass food production; suffice it to say, however, that it depends on the scientific interpretation of each step of the process in order that proper control can be exercised. To deposit on a continuous band going through an oven the mixture which eventually comes out as a baked product in the form of miles of sponge for

Swiss rolls demands a knowledge, not only of the flour and sugar and other ingredients, but of the metal of the plant used. It is comparatively simple when the jam filling is spread by hand on the sponge to even out differences in the physical state of the jam, but when that jam falls as a cascade on the cooled sponge, control of the jam, based on a scientific knowledge of the factors influencing its structure, becomes an absolute necessity.

It is comparatively easy to fry fillets of fish in wire baskets, but when thousands of battered fillets have to be fried in a continuous fryer the problems caused in the deposition of the batter (excess batter being blown off by air jets), in the presentation of the fish to the continuous band passing through the bath of oil and the assurance that the fish does not stick to the band, and in the continuous clarification of the frying oil by centrifugal means, all demand very specialized scientific knowledge.

But there are many aspects of the use of science in food manufacture slightly different from those I have mentioned. What is it that makes a manufactured tea good quality? The tea-taster in his own jargon can explain what he means by 'quality'. The tea-planter by trial and error has arrived at methods of cultivation which provide those attributes which the taster requires. The geneticist by long and laborious breeding helps the planter. Neither of them knows for what he is really looking. So the chemist comes in. Some fifteen years ago the Indian Tea Association, which has a wonderful research station in Tocklai (Assam), instituted work in London on 'Made Tea', that is, tea as sold by retailers, with the idea of separating tea into its constituent parts. Soon it became evident that there were chemical entities which were desirable and others which were not. The work continues but eventually it is anticipated that the major grouping affecting quality will be known. This information in the hands of Tocklai will enable the geneticist to get indication of his breeding plans and will also enable the planter so to modify his growing and manufacturing methods that he will be saved the trouble of carrying out lengthy *ad hoc* experiments.

It is said that 'Necessity is the mother of invention', and the following example rather indicates that this is true. In the old days newly milled flour was allowed to age, whereby its baking properties were considerably improved, but the flour had to be kept for some time before it could be used. Some forty years ago, it was found that certain chlorine bodies could be used to treat flour whereby not only was the colour improved by the bleaching action of the chlorine but the effect of aging was also secured. A few years ago came the bombshell of the work of the Medical Research Council, Lady Mellanby having proved that this treatment not only impaired the nutritive value of the flour, but that a body was formed during the treatment which, fed to dogs, produced a kind of hysteria. It was, of course, not proven that this body had any immediate effect on man, but the situation thus revealed gave cause for anxiety and, as a precautionary measure, it was obviously desirable that the bleaching and the aging of flour by chlorine compounds should be discontinued. To revert to the old method of keeping flour in order to age it was hardly practicable—the amount of storage space would have been colossal and the fact that so much capital would have

been tied up in the stocks of aging flour would have added to the cost considerably. So the chemists took the matter in hand and, in conjunction with the engineers, a new method of bringing about the oxidation by purely physical means has been evolved simply by altering the method of making the dough—a method which not only improves the baking qualities of the flour during the doughing process but also improves the colour. More of this method will probably be heard in the future, but it is too early to forecast its potential success.

Although I dismissed the plastics industry a few minutes ago, it has had an important effect on food production. I do not refer to the parts of machinery or equipment made from plastic material, causing a revolution in certain aspects, but to the packing of food for retail sale. About thirty years ago the only packing materials available to give real protection to food were waxed papers, cellophane, tin containers or metal foil. To-day there is a whole section of plastic material, used either separately or laminated with other wrapping materials, from which the food manufacturer can choose according to the needs of a particular product.

Control can only be effected in a scientific manner by analysis. Now analysis is, of course, only one aspect of the science of chemistry, but it is a most important aspect; in fact, analysis is the basis of the technique of chemical operations. No synthesis can be accounted complete until the synthesized product has been analysed and its component parts established and determined. In fact, chemistry is based on analysis. Analysis determines a common language for chemists and industry; it is equally as important and as essential as nomenclature and, as nomenclature is international, so must the methods of analysis and the interpretation of the figures thereby obtained be also international. The need for international agreement becomes obvious when analysis is applied to industry: it is significant that one of the sections of the International Union of Pure and Applied Chemistry (IUPAC) is that of Analytical Chemistry.

And here I want to digress for a moment. The United Nations has three major organizations which directly or indirectly concern food. They are the Food and Agriculture Organization, the World Health Organization and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Let me pay a tribute to E. F. Armstrong. The original plan was that the organization should be UNECO—no science—and it was his inspiration and his force of character that got the 'S' into the title. I do not propose to dilate on the very important work which these organizations have carried out. Since its foundation UNESCO has contributed largely to the funds of the international unions and the one with which I am intimately concerned is the union I have just mentioned, namely IUPAC. This Union has a number of sections, Organic, Inorganic and so on, and the one with which I am directly concerned is the Applied Chemistry Section. This section in turn has a number of divisions, and the two which are of interest to us to-day are the Oil and Fats Division and the Food Division. It is quite understood that the question should be asked, 'What does the Union do?' Chemists will realize the importance of one part of its work: it decides through an appropriate committee all changes in atomic

weights! Nomenclature, as I have already mentioned, is one of its functions. But, and this is an important point in connection with international agreement, it suggests methods of analysis. These, of course, have no legal standing but through its work it feeds such organizations as the International Standards Organization (of which the B.S.I. is one member) with methods which may then be incorporated in international specifications. International trade demands that the seller of olive oil in Spain and the buyer in any other part of the world should use the same methods of assessing the quality of the oil. The Division of Oils and Fats is intimately connected with and in fact responsible for the methods to be used in such assessment.

Lately, too, the Food Division has set up two committees concerned respectively with 'Vitamin Assay in Foods' and 'Determination of Metallic Impurities in Food'. But all this work demands finance and, at present, the work of the Union is hampered. The grants from UNESCO and from national adhering bodies are not sufficient to permit the work to be expanded as it should be, and an approach is shortly to be made directly to industry to supplement the meagre funds at our disposal.

Industry that is sparing in money for the scientific side of process development does not deserve to succeed. Every firm gambles: it gambles on consumer taste, it gambles on the possible success of a process, it must gamble on the ability of the scientist to help and must give him facilities both of time and money. It is obvious that on the work of the scientist may depend a decision regarding a new process. In these days, when by-products often turn the scale of economic possibility, knowledge of the possible use of such by-products is of profound importance to industry in general and to the food industry in particular.

Reference has already been made to legislation. The ever-increasing number of food laws on the statute books of the countries of the world brings with it problems of control which only science can effect, and the major group of scientists concerned with this aspect are chemists. It will be realized that these laws consist essentially of two kinds, those which limit the amount of any metallic or other type of impurity in a food and those which give a limiting value for one or other ingredient, to which must now be added a third group—artificial colours, and stabilizing and emulsifying agents.

It is not my purpose here to deal with these various types of regulations in detail, but it will be realized that each one depends for its enforcement on analysis. And it is self-evident that not only must the analyst be efficient, but that the method of determining any one substance must be sufficiently standardized to enable a group of chemists, given equal knowledge and technical ability, to arrive, working separately, at the same answer. There is very little that is absolute; the answer found will depend on the method employed and these methods are constantly in a state of flux as research workers in analysis find different methods and as other tools become available. The old classical methods in chemistry are gradually giving place to methods more allied to physics, and what is known as 'instrumentation' is becoming more and more evident in all laboratories.

With this comes an ever-increasing cost in the fitting up of a laboratory, accompanied by a saving in time, that is, of labour, and the possible use of cheaper labour. With, for example, a Kappa moisture meter—an electronic device—the time required to carry out a moisture determination is cut by about 80 per cent; with a flame spectrometer, potassium can be determined in about 10 per cent of the time taken by a standard chemical method. It will be realized, therefore, how important such methods are for factory control purposes.

The determination of metallic impurities, copper, lead, zinc and arsenic, is comparatively simple, but when the problem is to define the amount of certain ingredients present in a food a very different state of affairs exists. It must be remembered it is not the palatability or even the purity which is in question, and many of the ingredients are, from the point of view of the scientist, difficult to define. For example, if the law says a pork sausage must contain a certain amount of pork, it is necessary to be able to define pork—meat or fat—and then to find some chemical ingredient of pork which will be a pointer to the amount of pork present.

Likewise, if the law says that a fruit drink must contain a certain legal minimum of fruit juice of the particular type, orange, lemon or lime, then methods of assaying any drink must be devised so that not only those responsible for the enforcement of the law but also manufacturers agree on the composition. There is, of course, the right of entry, by which officers of the Government can enter any factory and inspect any process being undertaken, but this is not scientific and does not, therefore, concern this lecture.

The advance in science, including medicine, has resulted on the one hand in an ever-increasing number of chemicals which might be added to food and, on the other, in a recognition of potential dangers of the addition of such chemicals. The colouring of foods has been practised from time immemorial but during the last few years, with the ever-increasing activity of chemical industry, the range of substances having a tinctorial value has multiplied many-fold. Some years ago, the United States drew up a list of permitted food colours whereas we had a list of forbidden colours, but, in view of the presumed carcinogenic nature of certain of the molecular structures of dyes, we in this country are going over to a 'Permitted List'. It is a precautionary measure which will be accepted by food manufacturers without hesitation.

The eye is an important factor in the enjoyment of food and food enjoyed is good for man. Without an eye or without a nose how many people can differentiate between different flavours? Some time ago I gave a talk at Harrow School and had prepared a number of boiled sweets: 'lemon drops' coloured strawberry; strawberry sweets coloured raspberry; orange sweets coloured green. Could the enthusiastic tasters, experts, tell the flavours? No!

The same committee which has been set up to advise the Government on the question of colours is also concerned with other types of chemical additives of food. To quote an example: fats and oils, either animal or vegetable, have a greater or less propensity to develop unpleasant flavours due to an oxidation process. Oat flour contains an ingredient which retards this oxidation and

consequently the treatment of oils by oat flour gives them greater stability and keeping properties. This treatment has been known for many years; in chemical terms, the oat flour contains an antioxidant. With the spread of chemical knowledge many pure chemical entities have been synthesized which have this antioxidant character. Have they any deleterious effect on human metabolism? That is the question which has to be solved. To quote an example of another type: ice cream is a mixture of milk products, fat, sugar and flavouring matter. Oil and water, however, will not mix and, although milk does contain certain substances which aid in the formation of stable emulsions, that is, mixtures of oil and water which will not separate, there is not sufficient to retard this separation until such time as the mixture is frozen. Therefore an added emulsifying agent is necessary. The classical one used by chefs for centuries is gelatine and until a few years ago gelatine was the ingredient added, even in the mass production of ice-cream. During the last few years, however, the impact of chemical research has become evident and many emulsifying agents have become available. Are any of these harmful? Medical science, genetics and physiology must provide the answer—an answer which is being sought by the same committee, sitting under Sir Charles Dodds, as has dealt with colours and antioxidants.

It is of imperative importance that direction be given to the food industry regarding all these modern substances added to food—added in good faith and in no way being any type of sophistication.

It is to the credit of the food industry that certain of the larger firms recognized their duty to the public long before detailed legal requirements had to be met. The firm which E. F. Armstrong served was one of these. That which was unusual forty to fifty years ago has become commonplace. Every big food firm employs scientists and the small firms have their laboratories in the research associations. It is of some significance that Armstrong's successor at Reading, Dr. Colgate, should be Chairman of the British Baking Industries Research Association.

I feel I have only found it possible to deal with certain aspects; I have not dealt with that most important aspect of science, the study of micro-organisms, whereby the bacterial purity of the food is safeguarded; nor with the work of the entomologist concerned with the evidence of insect attack, whereby so much food is destroyed. The Food and Agriculture Organization of the United Nations is much concerned with this; they estimate that some 40 per cent of rice grown was destroyed by rodents and insects. Nor have I dealt with the romance of dish-washing and the changes in method brought about by synthetic detergents.

And so my sketching goes on. Sometimes it seems unfortunate that the work of so many careful, enthusiastic men is not recognized by the public. I see in the papers that a Dr. Ward has invented a lead suit to wear in case of an H-Bomb attack. That 'hits the headlines'. Incidentally, I also note he said in a press interview that when he has completed his own suit, he proposes to make one for his wife!

Perhaps the function of science in food preparation can be stated to be to

provide more abundant food, to provide cheaper food, to provide purer food and (I am sure I speak for all scientists in the food industry, from the soil to the consumer) the pursuit of these three has unfolded a story of adventure and imagination.

THE CHAIRMAN: I am sure that Dr. Lampitt, by the reception of his lecture and the enthralled gaze of his audience from start to finish, has had the greatest reward that a lecturer can have.

I must just say one or two things about points in Dr. Lampitt's lecture that fill me with a certain amount of uneasiness. This desire for, and obvious pleasure with which he discussed, those experiments on the schoolboys rather made me wonder, when one thinks of the tremendous potentiality he has for experimenting, if we are really wise to go to certain places we probably do go to! But I am sure that if he does experiment with us in that way, as a good gourmet himself, it will all be covered up and I am sure we shall have no idea of the experiments in which we are taking part.

I do feel sure that you would agree with me that one of the great beauties of this Society is that we are always addressed by experts in their own line and I do not think that we have ever heard a lecture by a greater expert than our lecturer to-day. He has given us a wider view of this vast subject and, before closing the meeting, I would like to call upon Professor Kay to join me in my appreciation of the lecture.

PROFESSOR H. D. KAY, C.B.E., F.R.S.: It is a great pleasure to me, as a former Chairman of the Food Group of the Society of Chemical Industry, to second this vote of thanks. I know the work that Dr. Lampitt has done for the Food Group for many years. He was the inspiration of its early days and has always kept an avuncular eye on its activities, and has willingly helped, whenever he has been asked to do so, ever since.

His lecture to-day has been, as we should expect of him, thought-provoking and stimulating. He has raised points that some of us would like to take up with him privately afterwards, since there is no official discussion after this lecture. A great deal of what he has said to-day is derived from his own experience in the food industry, an experience not only vast but almost unique, since he has for many years been in charge of a laboratory which deals with both the fundamental and the applied aspects of food science, which means a staff not only familiar with laboratory matters, but ready to tackle the industrial implementation of these findings.

I happen to belong to a small group, called the Science and Industry Committee, which is concerned with that particular aspect, of industrial implementation of proven scientific advances. Mr. Luckhurst is also a member, and I think he will agree with me that one of the most important things in this country at present is a speeding-up of the rate at which scientific knowledge we already possess is applied in industry. Dr. Lampitt is an example, I think, of one who has been able to accomplish that. His splendid laboratory and staff are the leaders in one of the most important sections of the food industry. I think I know sufficient of that very large industry to be able to assure you of that.

Before I sit down, may I couple with what I have just said about Dr. Lampitt and his magnificent lecture to-day a tribute to the Chairman and our hearty thanks to him. I have sat under his chairmanship several times and I hope he will allow me to record my experience that, as we have seen to-day, he has the knack of saying the right things, and neither too little nor too much. At this late hour I must not say too much either, but put this vote of thanks to the meeting.

The votes of thanks to the Lecturer and Chairman were carried with acclamation, and the meeting then ended.

THE DEVELOPMENT OF BROADCASTING IN BRITISH AFRICA

A paper by

J. GRENFELL WILLIAMS,

Head of the Colonial Service, British Broadcasting Corporation, read to the Commonwealth Section of the Society on Thursday, 2nd December, 1954, with W. Harold Ingrams, C.M.G., O.B.E., late Adviser on Overseas Information, Colonial Office, in the Chair

THE CHAIRMAN: It is a very great pleasure and honour for me to take the Chair this evening for my friend, Mr. Grenfell Williams. The subject, the development of broadcasting in Africa, is part of a wider one, in which we are all essentially very much interested, and what we are going to hear will, I think, do much to quicken our interest and also perhaps to make it more intelligent. I do not want to trespass very long on your time, but I should like to give you an idea of the frame in which I think we ought to look at our lecturer's picture. We, here, have come to regard broadcasting as an essential part of our everyday life, but this has not yet happened, not by a long chalk, in Africa but there is now sufficient evidence in Africa that they are going to think that way too. It is a very dramatic thing to watch the introduction of broadcasting into a new country and I, myself, sometime ago had a very striking experience of seeing it introduced into a country that not only did not know broadcasting, but also had practically no direct contact with the West. That was in a rather wild part of Southern Arabia. When I first knew it, it had no better means of communication with the outside world than it had had for the past three thousand years. But it had been famous as the centre of the incense trade and within its exclusive society there were cultured and civilized people. In 1936 I had the pleasure of flying the first radio sets there. We tied them on to the undercarriages of the biplanes we used there in those days, and in a very short time each of those sets had a large number of listeners. I was there again last year for a short time and it was quite extraordinary the way that broadcasting had become commonplace among at least the cultured part of the community. Ideas were heard as soon as they were spoken and were discussed in the market place. Broadcasting brings about an extraordinary revolution in thought. This, I think, brings home to one how extraordinarily important it is that this force should be developed on sound lines. It can make the whole world kin or it can make whole sections of the human race detest each other. Britain, of course, wants to be sure that this power is going to be used for good and we in Britain have, from the beginning, appreciated the importance of the developing of Colonial broadcasting.

The ultimate aim with Colonial broadcasting is to encourage the development of independent broadcasting authorities in the Colonies, though we have not yet reached that except in one case. The idea, of course, is that people shall acquire

an appreciation of its value which will forestall the risk of its being merely an instrument of politicians. The pattern for Colonial broadcasting was set by Lord Plymouth's Committee in 1936, which firmly established Colonial public service broadcasting, and the policy it laid down has been followed faithfully since. It was charged with preparing the means of accelerating the provision of broadcasting in the Colonies and co-ordinating them with B.B.C. services. The home government set the lines of development and provided some of the money, but the work on the whole has been carried out by a large number of Colonial Officers with the full and hearty and enthusiastic support of the B.B.C. This has meant that the Colonies are developing their own genius in broadcasting and at the same time they are getting benefit of the great skill of the B.B.C.

I cannot really describe here—it would need a separate talk and I should not be qualified to give it—what the B.B.C. has done in this respect, but there is hardly a colony in the whole of the Commonwealth which is not under a very great deep debt of gratitude to it. You will be able no doubt to read some of that into what Mr. Grenfell Williams is going to tell you, but I dare say that you will not get such a clear idea of what Mr. Grenfell Williams has done himself. He has taken, from the beginning, a very deep interest in broadcasting in the Commonwealth and he has visited many of these Colonial areas. In addition, he is the author of the standard book on the subject, the UNESCO book on mass education called *Radio in Fundamental Education*, which is available at the Stationery Office. It is no overstatement to say that broadcasting in many areas owes a very great deal indeed to his personal inspiration. He made formal recommendations for the development of broadcasting in the Gold Coast, whose government has just accepted the proposals of the delegation which he led there in 1952. He has led another delegation to Kenya last year and its recommendations are now under consideration.

There is just one final point I should like to add to that, and that is that Mr. Grenfell Williams is, in what I think is the right use of the term, an African himself. He was born in Johannesburg and he came here from South Africa. In fact, he was visiting his homeland a few months ago and one of the greatest things I think he has done is to inspire those who are African by race. He has taken a very great part in the training of Africans in broadcasting in London, and he has personally helped them in grasping modern techniques; and, as is evident this evening, he has many African friends himself.

The following paper was then read:

THE PAPER

I suppose that the most striking thing about the development of broadcasting in Africa generally is that the vast majority of Africans—the African population is something like 160 millions—have never heard a broadcast. Most Africans, even those living in the remotest parts, have seen something of the technical wonders of the West. The man tilling his fields on the slopes of Kilimanjaro hardly raises his head when a great air-liner passes over, and men, women and children crowd into the buses which go rattling and snorting over the roads of Africa, and they even fly happily over the airways. But broadcasting, which in theory knows no barriers of mountain, forest or swamp, has not, in fact, reached as far, or as potently, into the heart of Africa as the internal combustion engine. The main reason for this lag in broadcasting development is, of course, a financial one. Broadcasting in Africa began in those countries—like Egypt, Rhodesia and South Africa—where technical advance was greatest and where people could afford to pay for their broadcasting, and for radio sets. In the rest of

Africa, two financial factors—the cost of building and running broadcasting stations and the poverty of the people, most of whom, it was thought, could never afford to buy even the cheapest radio set—created what at one time looked like an almost permanent block to broadcasting. And when to this obvious difficulty was added a lack of knowledge of the techniques of broadcasting to people to whom broadcasting would be new, and—at least in some circles—a real fear of the effects of broadcasting on the minds of the people, it is not hard to understand why broadcasting in these areas advanced so slowly during the years when broadcasting was leaping ahead in other parts of the world.

There were some bold spirits who had gone pioneering into this difficult and unknown field. Kenya had a broadcasting service quite early, but it was designed to serve mainly the European and the Asian audience, not the African. In Sierra Leone, the Gold Coast and Nigeria, under the stimulus of the personal enthusiasm of governors and officials, wired-broadcasting systems were set up. By wired-broadcasting is meant, of course, the conveying of programmes by means of wires into the homes of the listeners who pay a rental for their loud-speakers. And there were some experiments in community-broadcasting in Uganda and a few other parts of Africa. But no attempt was made to reach the great mass of the people, particularly the people in the rural areas.

Even the recommendations of the committee set up to study Colonial broadcasting under the chairmanship of Lord Plymouth in 1936 had very little immediate effect. That committee envisaged the rapid growth of broadcasting throughout the African and other Colonial territories and recommended that broadcasting should be developed by governments as a public service. The war, though it caused a delay in any plans which might have been taking shape in the deliberations of some African Colonial Governments, provided an opportunity for some territories, such as Northern Rhodesia and Somaliland (which began its broadcasting romantically, in army tents) to start broadcasting, and for others, such as the Gold Coast and Nigeria, to develop their systems. The Gold Coast was particularly fortunate in this matter. For that colony, because of its peculiar position in relation to French African territories, was supplied with a transmitter powerful enough to reach those parts of French Africa which were under Vichy control. And that transmitter, when it was not being used for its special purpose, was available for broadcasting in the Gold Coast itself and served as a most useful link between Accra and the various wired-broadcasting centres.

It was, however, not until after the war that broadcasting in British Colonial Africa began to make real progress. In May, 1948, the Secretary of State for the Colonies addressed Colonial Governments in these terms: 'I hope that every Colonial Government will consider whether its existing arrangements for broadcasting are adequate; and whether in the case of those Colonies without broadcasting services, whether some action can now be taken to develop those services'.

This exhortation was timely. In 1948 the fermenting brew of new political ideas and aspirations was reaching the brim of the pot in some parts of Africa;

in others it had already spilled over the brim. And the pace of political development was rapidly exposing the gap between the legitimate ambitions of the people to control their own affairs, and the lack of education, technical skill and general political knowledge which would enable them to control the complicated structure of a modern state when political responsibility had been achieved.

In this situation most of the Governments readily accepted the idea of expanding or setting up broadcasting as a means of spreading authentic information quickly and of assisting the people in their social, economic and political development. But the financial stumbling block remained. Many Governments felt that their budgets could not bear the large capital cost involved in the erection of broadcasting stations, and some even could not face the total recurrent expenditure. It is interesting to note here that the Governments considered the possibility of finding the necessary capital from commercial sources and the revenue from advertising. Most of them decided not to embark on this form of broadcasting. It is true that the financial returns, at least from African listeners, were doubtful —the number of listeners was small and its growth problematical. One Colony attempted a mild form of advertising over the air, but gave it up after a very short and unprofitable experiment. Another practised, and still does, what is called spot advertising, but this is aimed at the European listener and, even so, brings in a relatively (relatively, I mean, to the total recurrent cost) small revenue. But I think it is fair to say that the real reason behind the decision was the feeling that if broadcasting were to play its full part in development it should be free to devote itself entirely to that purpose, without being diverted by the need to find revenue from advertising with the consequent competition for good listening times. By this I mean simply that the best, the most profitable listening time for programmes carrying advertising is obviously the time when the public service broadcasts could have their greatest effect. Not that any broadcasting organizers in their senses would want to inflict on their audiences a continuous series of uplift programmes. Indeed, entertainment is as important in broadcasting as is education or information; and catching the ear of the listener is essential for all these purposes. But there it was. These Governments wanted public service broadcasting and if it were to go ahead the money had to be found.

It was a decision of His Majesty's Government which took off this particular brake. A sum of £1,000,000 from Colonial Development and Welfare Funds was allocated for the development of Colonial broadcasting, and this was expanded in 1952 by a further £250,000. Almost at once things began to happen in African broadcasting. In Northern Rhodesia a gift of £187,000 was made towards the capital cost and part of the recurrent expenditure for a set period. A service for Africans in the three territories of Northern and Southern Rhodesia and Nyasaland was rapidly built up. In Nigeria, with a grant of £190,000, which does not include recurrent cost, a service was quickly and efficiently expanded from the nucleus of the old wired-broadcasting system, until to-day it is approaching the end of a technical plan which will cover the whole country with broadcast transmissions. Nigeria indeed is now moving into a new phase. Plans

are being worked out to change the present government broadcasting service into a public broadcasting corporation. In Tanganyika, Uganda, Kenya and Somaliland there have been advances, though on a smaller scale than those of Northern Rhodesia and Nigeria. It should be said, however, that as far as Kenya is concerned there has been, since the emergency began, a very remarkable growth in the broadcasting service for Africans, and I had the opportunity in April this year of seeing evidence that these broadcasts were making a real mark. Kenya too is considering a plan for a very large development in its broadcast service to Africans, Asians and Europeans. In the Gold Coast the report of a Commission which examined broadcasting in January last year was accepted by the Government, and during the last few months the first steps were taken to implement the plan. In Sierra Leone a scheme is being considered and it may not be very long before something happens there too. Of British African territories only one, the Gambia, is still without regular and permanent broadcasting systems for the local inhabitants.

With this fairly rapid growth, and the financial difficulties at least partly overcome, other problems asserted, and are still asserting themselves. Technical problems, large and small, from the difficulties of erecting a large station with untrained or partly trained workers to the strange and sometimes devastating effects of a tropical climate on delicate equipment. There is, I am told, a breed of insects in West Africa which has developed a taste for insulating material; and some fishermen in Nigeria found the lead on cables so useful for weighting their nets that no line was safe until a protective juju was arranged by a fetish priest. There are difficulties caused by the multiplicity of languages and the endless staffing difficulties which seem to be different in every territory because of local peculiarities. There is the special problem of listener research: how to find out not only whether listeners liked or disliked a programme, which is the main object of listener research in this country, but whether the programmes have the intended effect. In one territory, tribesmen assured an investigator that, as a result of listening to two series of programmes, they would try to improve their cattle by the methods suggested in one set of broadcasts, and would see that their girls went to school as advised in another series. This information was most satisfying to the broadcasting authorities, until they discovered later that this tribe lived in a tsetse area and had no cattle and that there was no school to which they could send their girls.

But all these problems are part of the excitement of this sort of broadcasting, and they are being solved. By a sort of combined operation between the Colonial Governments, the broadcasting officials, the Colonial Office and the B.B.C., financial, technical, staffing and training difficulties are being overcome. The B.B.C. because of its long experience and its resources has been able to help in many ways: by conducting surveys and giving advice when asked to do so, by seconding staff to Colonial stations, by providing programmes either through the rebroadcasting of its overseas transmissions or by recordings sent out to be broadcast locally. These may be programmes chosen from the general output of the B.B.C. or programmes specially prepared for use in the Colonies, like

those made by the Colonial Schools Transcription Unit, which is financed by the Colonial Development and Welfare Fund. The B.B.C. helps also by training Colonial broadcasting staff, technicians, administrators and programme men and women by giving them courses. I am happy to see here to-day several broadcasting students from Nigeria and the Gold Coast.

On this question of training, I would say that the B.B.C. can do no more than train these broadcasters in the techniques of broadcasting as they are known in the United Kingdom. The application of these techniques to the problems of reaching an audience in another environment, through a medium which is strange to the people, and in an idiom, not merely a language, which they will readily understand—that is a matter for the broadcasting officer who knows and understands his own people. Indeed he will, I hope, not be hide-bound by the programme techniques or the conventions the B.B.C. has built up over the years, but will use the medium as something fresh, something new to his people, as indeed it is. If this happens, and I believe it will, one may see in these countries broadcasting taking on a new life at a time when, in the West, sound broadcasting seems slowly but surely to be giving ground to television. Indeed there are signs already that in broadcasting Africa is exhibiting an astonishing and exhilarating vitality, as Africa so often does in its surprising unaccountable way.

No one who has heard the paddlers' Mass of Brazzaville Cathedral booming and throbbing over the air from Lusaka, as the choir chants its Gregorian-like music to the rhythm of the paddlers' drums, or the Yoruba carols, again with drum accompaniment, from the Lagos station, or the talking drums from Accra, or the wild exciting music sometimes heard from the Nairobi station, none who has heard these things could fail to believe that Africa has something completely new to give to broadcasting.

In Northern Rhodesia I saw a circle of Africans sitting on the ground under a tree in the grounds of the broadcasting station. A man addressing them was, I was told, a producer and he was rehearsing the group in a play. It was not my picture of a rehearsal for a broadcast play. There was a great deal of talk and laughter but no scripts. It turned out, in fact, that most of the actors were illiterate. After the rehearsal they trooped into the studio and then, before a small studio audience, performed their play at the microphone entirely unself-consciously and with great aplomb. It took about thirty minutes and was, if I could judge by the joy on the faces of the audience, a rip-roaring success. How it is done I do not know, but apparently each actor having been given the story and the general line of his part, lives and speaks his part as he goes along. Imagine a group of British actors being asked to perform a broadcasting feat like that.

Again, there was the incident of the broadcast by an African sergeant of the Kings African Rifles from London to Rhodesia at the time of the Coronation. He was asked to give an eye-witness account to run about five or six minutes of what he had seen during the day. Without a script and without a rehearsal, he did this, speaking in his own language with a fluency and an

ease of manner that would have been the envy of some of our professional commentators. While he was broadcasting, I brought his chief and his elders into the control room off the studio. The sergeant saw the chief out of the corner of his eye, and at once, as the chief told me, began a running commentary on the arrival of his chief, how well he looked, how magnificent he had been in the Coronation ceremonies, how his elders looked and so on. That is the sort of thing the B.B.C. trains people for years, and pays them considerable sums of money, to do.

In Kenya once I found the African staff busy producing the trial scene from the *Merchant of Venice* in Kikuyu. When I discussed the script with the African producer, he told me that because his audience would not accept the idea of a woman behaving as Portia did he had left her out. There was no real loss, he said, because he had given her speeches to the judge and that would not be a difficulty for his listeners because they were used to the idea of a district officer being both judge and defending counsel.

One more incident—this time in the Gold Coast—comes to my mind. I did not see this myself. It was told to me by John Wilson, the broadcasting officer. The story, I may say, illustrates some of the perils, as well as the excitement of this sort of broadcasting. A great chief had died, and the broadcasting officer, with difficulty, had persuaded the royal drummers to break a tradition, and bring their drums to Accra to reproduce on the air the ceremonial drumming and the singing of the praise songs. Three minutes before the broadcast the drummers were all in the studio, their brilliant cloths swathed round their waists, arms and shoulders bare, the sticks almost poised, when the chief drummer who had been showing signs of uneasiness in the strange surroundings of the studio, suddenly said that a libation should be poured before the drums could speak. The producer, beside himself with anxiety, dashed to the house of a friend nearby, seized a decanter of gin and rushed back to the studio. The gin was quickly sprinkled and, only a few seconds late, the great male drum began to throb and the chant began, 'A mighty tree has fallen. . . .'

If African broadcasting goes on producing this sort of programme, and it is doing so all the time, there is no reason why the listeners to these new stations and the broadcasting officers should ever have a dull moment.

Broadcasting, if it is to be enjoyable, and if it is to be effective in whatever it is trying to do—entertain, inform or educate—must grow out of and reflect the environment in which it is heard.

I always remember an afternoon when I sat taking tea with a very old, very dignified ruler in Nigeria. At the gates of the courtyard, which we could see from the windows, thousands of women in blue head-dresses surged and swayed as they chanted, with a wail like the wind, the death songs against the chief—songs which demanded his abdication or suicide. A loudspeaker above the gate blared out a raucous sound which to me was just distinguishable as a well-known B.B.C. variety programme. Oddly enough it was 'Up the Pole'. It was distinguishable to no one else in that place. Indeed, no one took the slightest notice of it, neither the chanting women nor the police, nor the chief's attendants nor the

chief himself. It was, in fact, merely another noise added to the already appalling din of the afternoon.

At that time most of the broadcasting in Nigeria consisted of an almost continuous relay of the B.B.C.'s Overseas Service. And it was clear that for the great majority of the listeners that kind of indiscriminate rebroadcasting of the B.B.C. could have neither meaning nor effect. Now, with the developments of the past few years in Nigeria, things are very different. Certain B.B.C. programmes, particularly the news and the special programmes for West Africa, are rebroadcast by the new Nigerian Broadcasting Service, but most of each day's broadcasting time is increasingly being used for programmes which are made in Nigeria, which reflect the day to day life of the people themselves, the events which are important to them, the topics discussed in their market places, their music, their stories, their politics. It is, in fact, the pattern of all healthy broadcasting everywhere in Africa.

But there are, as I have said, still many and great problems. Not the least of these is posed by the question of what should be the relationship between governments and the broadcasting organizations in these countries. All of them are advancing politically; some have reached almost complete responsibility in their own affairs. What, then, should be the status of the broadcasting organization and what degree of independence should it have? Ideally, I have no doubt myself, a broadcasting organization can only reach its full growth and its full flowering if it is independent of government control. But, in practice, the degree of independence which a broadcasting organization can have depends on many things. It depends on its financial independence—and that is a long way off for most of these organizations—and it depends even more on a staff trained not only in the necessary broadcasting accomplishments, but, above all, in exercising that judgment which is necessary if responsibility for public service broadcasting is accepted and demonstrated. This complex matter, will, I believe, work itself out. Already, as I have said, Nigeria is forming its own public corporation. And when I served on the Commission in the Gold Coast last year and in Kenya this year I found on all sides an eagerness to have independent broadcasting and a readiness to accept the responsibility which must go with it.

Broadcasting is at the beginning of great things in Africa. But let me emphasize that it is only at the beginning. In addition to the problems I have mentioned there is the greatest one of all—how to reach any considerable proportion of the millions of Africa. We must face the practical, if unpleasant, fact that without electricity the only way for the African in rural areas to listen is on a battery set, and not a set for community listening—it is generally agreed that community listening is the most unsatisfactory and ineffective form of listening—but the private set in the home. And this poses a host of problems in itself, problems not only of the cost of the set and the renewal of batteries, but of supply, maintenance and transport, which I shall not go into now. There are hopeful signs, however: the experiment in Northern Rhodesia, where a British firm boldly went into the field with the first really cheap short-wave set, the 'Saucepan Special', has been successful, and other sets are now coming into the African

market. And there seems to be no doubt that if the African is given the kind of broadcasting he likes he will move heaven and earth to buy a radio set. And since he is a happily gregarious man, we may expect, not the three or four listeners to a set common in the United Kingdom, but ten or more listeners to each set. We may hope that they do not all suffer as did a schoolmaster in Northern Rhodesia who wrote, a little sadly I thought, to the Lusaka station to say that when he got home one afternoon he found his wife had turned on the newly bought Saucepan radio and 109 girls from the local school were filling his house and crowding round it.

What effect is all this having on the people of Africa? It is early to say anything definitely, but already it is possible to imagine the people of Africa becoming informed through broadcasting before they become educated.

If we who are engaged in Colonial broadcasting could get, every day, a letter like that written by one of the new 'Saucepan' owners to Lusaka, we should never be discouraged. This man wrote: 'My brother have bought a new model wireless I and my brother have learnt a great deal of things that we never knew before in our poor lives through it'.

After the lecture, five recordings were played and a film was shown. The recordings were: a song from Lusaka illustrating the transition from African to Western music; one short piece illustrating the way in which a topic such as 'African and European Customs' is handled at Lusaka; a recording of the Yoruba Talking Drum, and two short extracts from the B.B.C. programme 'Talking to Teachers' and a Yoruba hymn with drums. The film, which was called 'Lusaka Calling', tells the story of the 'Saucepan Special' in Northern Rhodesia.

Because of the considerable time taken by the demonstrations it was not possible to have a discussion and the Chairman briefly expressed the thanks of the meeting to the Lecturer. Sir Selwyn Selwyn-Clarke, Chairman of the Commonwealth Committee, then commented on the paper in the light of his own experiences in West Africa and the Seychelles, and proposed a vote of thanks to the Chairman.

Both these votes of thanks were carried with acclamation and the meeting then ended.

GENERAL NOTES

ARTS COUNCIL EXHIBITION

The Arts Council is holding, at its galleries in 4 St. James's Square, an exhibition consisting of a large selection from the contemporary paintings, drawings, and sculpture which it has acquired. This collection, divided into several exhibitions, has been shown at a great number of places in the provinces during the last seven years, and this is the first time it has been possible to assemble it in London. Owing to the lack of hanging space 111 works only will be exhibited, the selection being taken from the very much larger number of purchases made by the Council between 1946 and 1955.

The exhibition remains open until 5th February, from 10 a.m. to 6 p.m. on Mondays, Wednesdays, Fridays and Saturdays, and from 10 a.m. to 8 p.m. on Tuesdays and Thursdays. Admission is free.

CORRESPONDENCE

'THE BRIDGES OF BRITAIN'

From MR. W. P. WARNER, P.O. BOX 22, KERICHO, KENYA COLONY.

When reading the review of the above book in the *Journal* of 29th October, I was most interested to see that the subject of human sacrifices by the ancients is mentioned.

I thought the following, which happened as recently as 1939, might be of interest to you.

I was supervising the construction of a lifting-span bridge across a river in Assam, India; an Indian woman brought a live month old baby to me and asked me to bury it in the concrete foundations, in order that the bridge would be safe for all time. My Indian workmen were most enthusiastic about it, and my flat refusal was not at all well received.

It would be interesting to know if this custom was once world-wide.

The author of the book, Mr. Eric de Maré, was invited to comment on the above letter, and wrote as follows:

I am fascinated by Mr. Warner's experience. The limited research I made on the mythology of bridges when writing my book did not prove that the custom of sacrificing a life when a bridge was being constructed was ever world-wide, but it did suggest that it was probably so.

The custom was certainly general in the whole of the East at one time, including China. The Ancient Romans in early days used to throw an old man into the Tiber once a year from the Pons Sublicius but in time the custom was dropped and an effigy was substituted for the human being.

Much folk-lore is attached to bridge building all over the world. For instance, Devil Bridges are common throughout Europe—that is, bridges said to have been built at supernatural speed by the Prince of Darkness in exchange for a life.

The subject of bridge mythology would make a book in itself. Can any of your readers provide more information or sources of information Is it true, for example, that when someone is killed during the building of a bridge even to-day the murmur goes round among the constructors: 'The bridge demands a life'?

Mr. Peter Opie, who lectured to the Society recently on The Collection of folk-lore in England, *was also asked to comment and replied as follows:*

Mr. Warner's letter gives a valuable example of how belief in the efficacy of a terrible rite can continue, under cover, into our own times. The most recent instance in that part of the world hitherto known to me was in 1872 when the Hooghly Bridge was being erected, and there was a scare amongst the natives in Calcutta that each pier of the structure was to be founded on a layer of children's heads. (G. L. Gomme, *Early Village Life*, p. 29.)

The belief that a blood sacrifice is necessary to the successful erection of a bridge has been current not only in Asia, but in Polynesia, in Africa, and, apparently, in most countries in Europe, including Britain. It is possible that our present-day custom of placing coins under the foundation stones of buildings is a relic of the practice;

and, more specifically, the internationally played children's game 'London Bridge is broken down' appears to contain a memory of it. (*Oxford Dictionary of Nursery Rhymes*, pp. 270-276.)

Instances of the sacrifice, with particular reference to bridges, are conveniently grouped together in E. B. Tylor's *Primitive Culture*, vol. 1, pp. 104-8. See also S. Baring-Gould, *Strange Survivals*, pp. 5-35; and J. G. Frazer, *The Golden Bough*, abridged edition, pp. 191-2.

OBITUARY

MR. GEOFFREY HOLME

We record with regret the recent death in Mexico of Mr. Geoffrey Holme, M.B.E., at the age of 67.

Charles Geoffrey Holme was for many years chairman of The Studio, Ltd., in succession to his father, the founder of that business. While editor of *The Studio* and the *Studio Year Book* (later renamed *Decorative Art*) and in association with Mr. F. A. Mercer, the present editor, he maintained the role of *The Studio* as not only the oldest, but one of the best known of the reviews dealing with contemporary art.

His interest in artistic matters, on which his judgment was remarkable, was great and varied. He was an active member of the Royal Society of Arts, to which he was elected in 1933, and contributed to the Society's *Journal*; he served on the Council of the Society from 1933 to 1945.

NOTES ON BOOKS

PORTRAIT OF BARRIE. *By Lady Cynthia Asquith. James Barrie Ltd.*, 1954. 15*s*

How very far from fact are facts! We all know, or ought to know, the mere facts of the medley of men called J. M. Barrie, for he himself spared no pains in telling them, however adorned with accompanying fancy. Mr. Denis Mackail, in his heroic biographical study, '*J.M.B.*', did what mortal can do to narrate the facts of Barrie's life with an interpretation of the phases of the man who had lived it. But—

> In search of thee the fancy deft
> Flies wide, and lets the quarry stray,
> And when all's said there's something left—
> And that's the thing I meant to say. . . .

Never was a harder personality to capture. Lady Cynthia Asquith seems to have achieved the impossible. As 'C. Greene', she was for many years J. M. Barrie's companion and confidant: she knew him in all his moods, penetrated the man behind all the poses. A distinguished woman of letters in her own right, she here sets down each trivial, fond record, with others by no means trivial. Her opening sentences limit and define the scope of her book.

> What was Barrie really like? . . . I could not attempt to sum up so complex a being; but I will try to give my day-to-day impressions of him and such characteristic speech as I can remember.

A memory, itself unusually retentive, is greatly helped by generous recourse to her letters and diaries of the period. When at the close of her book Lady Cynthia reminds the reader that it was never her purpose to attempt a summing-up she half retracts her self-imposed limitation of purpose by answering in sequence some of

the questions most asked about him. These direct answers to categorical questions are fascinating, but he would be dull indeed who had not from the flashing pages in between conjured the many Barries into being.

As novelist, essayist, playwright, personality Barrie created his own legend, the half-mock, half-genuine shy man, the arrant sentimentalist, the practical joker, the child worshipper with a mother-fixation. This legend Lady Cynthia does not dispel, but tempers. Nor is it Barrie alone whom she reveals by both anecdote and judgment. The writing peers of his time walk these pages again—Wells, Henley, Housman, Doyle, Chesterton, Anthony Hope, Birrell amongst them. Barrie in slippers in the famous flat in the Adelphi, Barrie the impish host at the historic country house, Stanway, Barrie the man of the theatre, facing the heart-break of the ill success of *The Boy David*, Barrie the benefactor, Barrie the enthusiastic, inept cricketer—all are here, evoked by something more than the artifice of prose. One learns some peculiar things in passing, as that Barrie proposed to omit *The Little Minister* from the collected plays, though it had earned £80,000 for him in ten years.

The abiding impression left by this portrait of an elusive personality is that of sincerity. If naught is set down in malice, naught is omitted from false tenderness. If the ultimate mystery of the moody Scot eludes the reader it is from no fault of the writer. Those whom Barrie irritated by such infantile pretences as a failure to understand what to do with a cheque will not lose their irritation: those who revelled in his every antic will find many another antic here displayed for their renewed delectation. It must in fairness, and for just measure, be added that Lady Cynthia has not only come as near as may be to limning the man, she has caught, too, the tone of his time and the savour of his circle. That means much, for Barrie was lucky in the era of his literary 'arrival'. No literary portrait could do him justice which was not a conversation piece. That, in more senses than one, Lady Cynthia Asquith has triumphantly achieved.

COLLIN BROOKS

LIBRARY ADDITIONS

SCIENCE

BARBER, BERNARD. Science and the social order. *Allen & Unwin*, 1953.

KLINE, MORRIS. Mathematics in western culture. *Allen & Unwin*, 1954.

NELSON, ALBERT FRANCIS JOSEPH HORATIO, *6th Earl Nelson*. Life and the universe. *Staples press*, 1953.

STRUIK, DIRK JAN. A concise history of mathematics. *Bell*, 1954.

AGRICULTURE AND GARDENING

GARDENS AND GARDENING: the Studio gardening annual; (editors, F. A. Mercer and Roy Hay). Vol. 5, Labour-saving planning and planting. *Studio publications*, 1954.

GRIST, DONALD HONEY. Rice. *Longmans, Green*, 1953.

INDUSTRIAL AND COMMERCIAL ART AND DESIGN

VAN DOREN, HAROLD. Industrial design: a practical guide to product design and development, 2nd ed. *New York, McGraw-Hill*, 1954. (Presented by the author).

ARCHITECTURE AND BUILDING

LE CORBUSIER. The Modulor: a harmonious measure to the human scale universally applicable to architecture and mechanics; translated by Peter de Francia and Anna Bostock. *Faber*, 1954.

WHITEMAN, G. W. Some famous English homes from the time of Henry VIII to the Regency. *Antique collector*, 1951.

CRAFTS AND LIGHT MANUFACTURES

CONNOISSEUR. Coronation book, 1953; edited and compiled by L. G. G. Ramsey. *Connoisseur*, [1953].

JENYNS, SOAME. Ming pottery and porcelain. *Faber*, 1953.

NICHOLSON, JOAN. Contemporary embroidery design. *Batsford*, 1954.

RACKHAM, BERNARD. Animals in Staffordshire pottery; with sixteen plates by Peggy Jeremy. *Penguin books*, 1953.

FINE ARTS

RICE, DAVID TALBOT. Byzantine art. Revised ed. *Penguin books*, 1954.

PAINTING, DRAWING, SCULPTURE AND ENGRAVING

ALSTON, ROWLAND WRIGHT. Painters' idiom: a technical approach to painting. *Staples press*, 1954.

BELFAST. Museum and art gallery. Exhibition of British bird art, 14th April—8th May, 1954: [catalogue]. *Belfast Museum and Art Gallery*, 1954. (Presented by the Belfast Museum and Art Gallery).

DAVIES, NINA M. Egyptian paintings; illustrated and described by Nina M. Davies. *Penguin books*, 1954.

GARDNER, ARTHUR. A handbook of English medieval sculpture. 2nd ed. *Cambridge, C.U.P.*, 1937. (Presented by E. G. Tasker).

GWYNNE-JONES, ALLAN. Introduction to still-life. *Staples press*, 1954.

HOBBIS, CHARLES IREDALE. Pencil drawing for the architect. *Tiranti*, 1954.

NAPPER, JOHN, *and* MOSLEY, NICHOLAS. Life drawing. *Studio publications*, 1954.

NORMAN, PERCIVAL EDWARD. Sculpture in wood. *Studio publications*, 1954.

RICHMOND, LEONARD. From the sketch to the finished picture: water-colour painting. *Pitman*, 1954.

COSTUME

CUNNINGTON, CECIL WILLETT, *and* CUNNINGTON, PHILLIS. Handbook of English costume in the sixteenth century . . . *Faber*, 1954.

LITERATURE AND AUTHORSHIP

WICKSTEED, JOSEPH HARTLEY. William Blake's 'Jerusalem' . . . *published by the Trianon press for the William Blake Trust*; [*Faber*, 1954].

BIOGRAPHY

CHUTE, MARCHETTE. Ben Jonson of Westminster. *Robert Hale*, 1954.

MERRIAM, FREDERICK WARREN. First through the clouds; the autobiography of a box-kite pioneer . . . *Batsford*, 1954.

HISTORY AND TOPOGRAPHY

[EDWARDS, TRYSTAN]. A new map of the world: the Trystan Edwards homalographic projection. *Batsford*, 1953.

JONES, SYDNEY ROBERT. England East. *Studio publications*, 1954. (Presented by F. A. Mercer).

MASSINGHAM, HAROLD JOHN. Chiltern country . . . 3rd ed. *Batsford*, 1949. (Presented by E. G. Tasker).

FROM THE JOURNAL OF 1855

VOLUME III. *5th January*, 1855

From a note on The Smoke Nuisance.

During the week commencing January the 15th, and ending January 20th, there will be exhibited in the Society's rooms a collection of models, drawings, and diagrams of apparatus or inventions for suppressing the smoke nuisance. It is hoped that the

collection will fairly represent the means by which this desirable end has been or may be attained. In each case a brief description of the invention, method, or plan, as well as of a list of the names of any places where it has been put in operation, has been asked for. Those who are intending to contribute to the collection should bear in mind that the models, drawings, descriptions, &c., should be sent in on or before Tuesday, the 9th of January.

On the evening of Wednesday, the 17th of January, Mr. George Muir, of Glasgow, will read a paper before the Society, 'on the Smöke Nuisance; considered Morally, Historically, Scientifically, and Practically,' when Mr. W. Fairbairn, F.R.S., will preside.

Some Activities of Other Societies and Organizations

MEETINGS

MON. 10 JAN. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. *Atmospheric Pollution* (Discussion).

Transport, Institute of, at Jarvis Hall, 66 Portland Place, W.1. 5.45 p.m. H. H. Phillips: *The Economics of Intensified Use of Railway Operating and Motive Power Resources.*

TUES. 11 JAN. Civil Engineers, Institution of, Great George Street, S.W.1. 5.30 p.m. B. E. Willett: *The Requirements of a Civil Airport as Typified by London Airport.*

Japan Society of London, at the Victoria & Albert Museum, South Kensington, S.W.7. 5.30 p.m. Daniel Duxbury: *Japan's Place in World Trade.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. W. B. Fisher: *Modern Turkey.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 4 p.m. L. J. Davies, G. Grime and J. H. Nelson: *Vehicle and Road Lighting.*

WED. 12 JAN. British Kinematograph Society, at G.B. Theatre, Film House, Wardour Street, W.1. 7.15 p.m. G. H. Sewell: *On Relinquishing Amateur Status.*

Archæological Institute of Great Britain and Ireland, Royal, at the Society of Antiquaries of London, Burlington House, Piccadilly, W.1. 5 p.m. J. T. Smith: *Medieval Aisled Halls and their Derivatives.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. E. G. Rowe, P. Welch and W. W. Wright: *Thermionic Valves of Improved Quality for Government and Industrial Purposes.*

Engineering Inspection, Institution of, at the Royal Society of Arts, W.C.2. 6.45 p.m. A. J. Peppiatt: *Inspection in the Motor Industry.*

Newcomen Society, at the Iron & Steel Institute, 4 Grosvenor Gardens, S.W.1. 5.30 p.m. H. W. Dickinson: *The Taylors of Southampton; their Ships' Blocks, Circular Saw and Ships' Pumps.*

Locomotive Engineers, Institution of, at the Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1. 5.30 p.m. G. V. Davy: *Recent Trends in Electric Locomotives.*

Petroleum, Institute of, 26 Portland Place, W.1. 5.30 p.m. A. T. Wright: *Insurance in the Oil Industry.*

Victoria & Albert Museum, South Kensington, S.W.7. 6.15 p.m. K. W. Luckhurst: *Early International Exhibitions.*

THURS. 13 JAN. Fuel, Institute of, at the Institution of Civil Engineers, Great George Street, S.W.1. 5.30 p.m. W. F. Cartwright: *Integration in the Iron and Steel Industry.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 6.45 p.m. *The Use and Misuse of Horizontal Borers.*

Textile Institute, at 10 Blackfriars Street, Manchester, 3. 7 p.m. F. W. Thomas: *Continuous Bleaching and Preparatory Processes.*

FRI. 14 JAN. Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 5.30 p.m. William Prager: *The Theory of Plasticity: Recent Achievements and Future Problems.*

SAT. 15 JAN. Horniman Museum, London Road, Forest Hill, S.E.23. 3.30 p.m. W. J. L. Sladen: *Iceland and Geese.*

TUES. 18 JAN. Civil Engineers, Institution of, Great George Street, S.W.1. 5.30 p.m. F. L. Wooldridge, John Cuerel and K. R. Rauch: *New Northam Bridge, Southampton.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. *The Human Operator in Closed Loop Control Systems* (Discussion).

Industrial Transport Association, at the Royal Society of Arts, W.C.2. 6.30 p.m. H. A. Lingwood: *The Port of London and its Functions.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. Prof. Max Gluckman: *Tribal Systems in Central and South Africa.*

WED. 19 JAN. Petroleum, Institute of, 26 Portland Place, W.1. 6 p.m. E. L. K. Frost: *Careers in the Petroleum Industry.*

Victoria & Albert Museum, South Kensington, S.W.7. 6.15 p.m. Alec Clifton-Taylor: *English Medieval Stained Glass.*

THURS. 20 JAN. Chemical Society, at the Imperial College of Science and Technology, South Kensington, S.W.7. 7.30 p.m. Prof. H. C. Longuet-Higgins: *The Role of the π Electron in Aromatic Chemistry.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. H. W. Wolff and T. G. F. Atherton: *Design, Performance and Application of Miniature Circuit-Breakers.*

Road Transport Engineers, Institute of, at the Royal Society of Arts, W.C.2. 6.30 p.m. G. Mackenzie Junner: *Accidents—Their Causes and Prevention.*

FRI. 21 JAN. British Sound Recording Association, at the Royal Society of Arts, W.C.2. 7 p.m. T. S. Livingstone and N. C. Mordaunt: *Demonstration of a High Fidelity Reproducing Chain.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 5.30 p.m. Cmdr. L. Baker: *Some Factors in the Selection of Machinery for Cargo Liners.*

SAT. 22 JAN. Horniman Museum, London Road, Forest Hill, S.E.23. 3.30 p.m. A. Robinson: *The Wonder of Bird Watching.*

OTHER ACTIVITIES

MON. 10 JAN. UNTIL SUN. 16 JAN. Imperial Institute, South Kensington, S.W.7. 12.30 p.m., 1.15 p.m. and 3 p.m. Weekdays, 3 p.m. and 4 p.m. Sats., 3 p.m., 4 p.m. and 5 p.m. Suns., Films: *Marine Marvels—India; Mountains of the West—Canada; Beautiful New Zealand.*

MON. 17 JAN. UNTIL SUN. 23 JAN. Imperial Institute, South Kensington, S.W.7. 12.30 p.m., 1.15 p.m. and 3 p.m. Weekdays, 3 p.m. and 4 p.m. Sats., 3 p.m., 4 p.m. and 5 p.m. Suns., Films: *Bears at Play—Australia; Land of the Lake—Nyasaland.*

NOW UNTIL 29 JAN. Italian Institute, 39 Belgrave Square, S.W.1. *Show Window of Italian Contemporary Art.*

NOW UNTIL 30 JAN. The Arts Council of Great Britain, at the Tate Gallery. *Exhibition of Paintings and Drawings by George Morland.*

NOW UNTIL 30 JAN. The Arts Council of Great Britain, at the Tate Gallery. *Exhibition of Paintings, Drawings and Engravings by David Jones.*

NOW UNTIL 12 FEB. The Crafts Centre of Great Britain, 16/17 Hay Hill, W.1. *Exhibition of Decorated Glass and Books.*